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Factsheet

ONTARIO BULL EVALUATION PROGRAM

(Revision of Factsheet "Ontario Bull Test Program", July 1988)

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INTRODUCTION

The goal of the Ontario Bull Evaluation Program is to evaluate the genetic merit of young beef bulls for economically important traits. This information allows producers to improve beef production through the selection of sires which are genetically superior for those traits.

HERD SIRE SELECTION

The selection of a herd sire is one of the most important decisions made by cattlemen. The herd bull has a very significant impact on the overall productivity (and profitability) of the beef operation. Many factors must be considered in the evaluation of potential herd sires. These include breeding soundness, genetic merit for economically important traits, and structural soundness. The Ontario Bull Evaluation Program provides valuable objective measurements which are very useful in several aspects of bull evaluation.

Measurements taken under the program include:

1. postweaning growth rate
2. backfat thickness
3. scrotal circumference
4. hip height
5. feed intake (some stations)

Cattlemen using this objective information will be more effective at selecting a herd sire with optimum performance characteristics to meet their requirements.

WHY GROUP TEST?

The Ontario Bull Evaluation Program uses a group testing concept to evaluate bulls for postweaning growth. The group test system allows bulls originating from different herds and different environments to be fairly compared for their genetic merit for growth rate. The bulls are fed and managed alike in a test group so that each has an equal opportunity to express its genetic merit for growth rate and other traits. Since the environment is common for bulls in a test group, differences in growth rate are primarily due to differences in genetic make-up. This principle, combined with the type of evaluation system used, provides a very powerful tool which can fairly compare bulls across herds, across breeds and across stations for their genetic merit for postweaning growth.

EVALUATION PROCEDURES

Bulls are evaluated year round in Ontario. Stations are operated at various locations throughout the province based on client need. Bulls are delivered to stations when they are 6 to 7 months of age. The first month in the station is an adjustment period. During this time, the bulls become accustomed to a new environment and are slowly introduced to the bull test ration.

Bulls are officially weighed "on test" at the end of the adjustment period. All bulls in the group are weighed at intervals of approximately 28 days until the end of the 140 day test period. Average daily gain (ADG) is calculated by the regression method for each bull using start of test weight, interim weights and end of test weight. At the end of test, each bull is measured for backfat (ultrasonically), scrotal circumference and height at the hooks. At the completion of test, an individual certificate is issued which includes bull identification, pedigree, station, herd performance, genetic evaluations and station measurements.

FEED

During the test period, bulls are offered a pelleted feed and long dry hay on a free choice basis. Free choice feeding eliminates competition among bulls for feed, ensuring that each bull gets all the feed it requires to satisfy its appetite and express its genetic potential. Use of a pelleted feed prevents sorting and selection of particular feedstuffs by individual animals. Sorting and selection would result in different bulls consuming different mixes of feedstuffs, which would bias test results.

The pelleted feed is moderate in energy (TDN), high in fibre and contains adequate protein, minerals and vitamins to meet the nutritional needs of growing bulls. Table 1 contains some of the nutrient specifications for the pellets fed in 1990. The pellets consist of about 50% ground fibrous feeds and 50% concentrate. During the test period, bulls consume an average of 4-6 lbs of long hay per head per day.

TABLE 1. NUTRIENT SPECIFICATIONS FOR OMAF BULL PELLETS, 1990

Nutrient	% of Pellet (Dry Matter Basis)
TDN	64.00
Crude Protein	15.60
Calcium	1.11
Phosphorous	0.63
Fibre (Acid Detergent Fibre)	21.36

HOW TO ENTER BULLS IN EVALUATION STATIONS

Producers wishing to send bull calves to an evaluation station must complete an application form and forward it, along with the proper application fee, to the Beef Improvement Office in Guelph. It is recommended that calves be nominated no later than 4 months of age. Application forms can be obtained from OMAF county offices, bull evaluation stations, or from:

Beef Improvement Program,
Animal Industry Branch,
Ministry of Agriculture and Food,
Guelph Agriculture Centre,
P.O. Box 1030,
Guelph, Ontario
N1H 6N1
Tel: (519) 836-3560

In order to be eligible for entry into a station, calves must meet the following criteria:

1. weigh a minimum of 400 lbs on delivery;
2. possess 2 normal testicles;
3. possess a complete and legible tattoo;
4. meet age requirements specific to the station;
5. meet health requirements, including preconditioning, as established by the Beef Improvement Program office, in consultation with OMAF cattle health consultants.

Note: preconditioning involves management and vaccinations which must be done well in advance of delivery date.

A copy of current entry requirements may be obtained from the Beef Improvement Program office.

COSTS TO CONSIGNORS

Bull owners are invoiced for a fee based on the number of days their bulls are at the station. The fee for the 1991 testing year is $2.20 per head per day. Bulls are usually at a station for about 170 days (30 day adjustment period plus 140 days on test). Bull owners who travel more than 50 miles (round trip) to deliver bulls are allowed a mileage credit on their final invoice.

GROWTH RATE GENETICS

Both the sire and dam contribute 50% of their genes to their offspring. However, a bull usually sires many calves, compared with the low number of calves born to a cow in a given year. Therefore, the genetics of the herd sire play the dominant role in influencing the genetic make-up of the calf crop. In herds retaining their own replacement heifers, the sires account for 80-90% of the herd's genetics.

A major component of the Bull Evaluation Program is the evaluation of bulls for genetic merit for postweaning growth. Postweaning growth is one of the most economically important traits of beef cattle, and has a high heritability (about 50%). Heritability is a measure of how much of a trait is passed from parents to progeny. When attempting to select for a trait in a breeding program, much faster progress will result if the trait selected for is of high heritability rather than low heritability.

Correlation Between Postweaning and Preweaning Gain

A bull which has superior genetics for postweaning growth rate will sire calves that also grow faster from birth to weaning and thus have higher weaning weights. This is due to the high genetic correlation (about 70%) between postweaning and preweaning growth. The high correlation means that many of the genes influencing postweaning gain also influence preweaning gain. As a result of this high correlation, selection for postweaning gain also results in a considerable degree of indirect selection for preweaning gain.

Correlation Between Postweaning Growth and Feed Conversion

Postweaning growth and feed conversion (lbs feed / lb gain) have a strong negative correlation (about -70%). This means that as postweaning gain increases, the lbs of feed required for a lb of weight gain decreases. As a result, selection for postweaning growth results in indirect selection for improved feed conversion.

GENETIC EVALUATION OF POSTWEANING GROWTH WITHIN BREED: THE EXPECTED PROGENY DIFFERENCE (EPD)

Comparing bulls across test groups using average daily gain (ADG) is not appropriate because gain is highly influenced by the environment present at each station. For example, poor weather at one location could cause low ADG's compared with ADG's at another location, although bulls at both stations could have identical genetic merit for growth rate. Other environmental factors include type of barn, feeding management and season of the year. To compensate for these factors, the ADG of each bull is compared to the average ADG of his contemporary test group. Test groups may consist of a variety of breeds, and there are significant differences in the average genetic merit for growth rate among breeds. Therefore, each test group average ADG is adjusted to reflect the numbers of each breed present.

Genetic merit for postweaning gain is reported as an EPD (Expected Progeny Difference). **The EPD is the expected difference in the average performance of the bull's progeny relative to average bulls of the same breed (all managed in the same contemporary group).** The EPD calculation takes into account the heritability of the trait and the fact that a parent contributes only one-half of its genes to its progeny. EPD calculations also include performance information on the bull's relatives which have been tested in the program. This information is weighted according to the degree of genetic relationship between the animals (i.e. half-brothers, sire, grandsire, etc.) and is used to enhance the accuracy of the evaluation (see Table 2). The EPD can be used to compare bulls of the same breed for genetic merit for postweaning gain, whether they were tested in the same group or in different groups.

The postweaning gain EPD is given in lbs of weight gain in a 140-day period. This corresponds to the 140-day test period. The average EPD for a breed is 0 lbs. EPD's are calculated for bulls which are at least 7/8 purebred. A bull's EPD will change over time as more of his relatives are tested, and this information is added into his EPD calculation. Updated EPD's can be obtained from the Beef Improvement Program office in Guelph.

TABLE 2. APPROXIMATE EMPHASIS PLACED ON BULL TEST PERFORMANCE OF VARIOUS RELATIVES

Bull Test Records Available on	Relative Emphasis (%)				
	Bull	Sire	MGS*	Brothers	Progeny
Bull only	100				
Bull + Sire	75	25			
Bull + Sire + MGS*	66	23	11		
Bull + 5 Brothers	62			38	
Bull + 10 Brothers	51			49	
Bull + Sire + 5 Brothers	58	15		27	
Bull + Sire + 5 Progeny	33	11			56
Bull + Sire + 10 Progeny	21	7			72

* *Maternal Grandsire*

USING THE POSTWEANING GAIN EPD

A bull with a postweaning gain EPD of +20 lbs would sire calves which, on average, would gain 20 lbs more over a 140-day feeding period than bulls of that breed which had average genetic merit (EPD = 0), if all were fed in the same contemporary group.

The relative genetic merit of bulls of the same breed can be determined by comparing their postweaning gain EPD's. Consider two bulls to be used on the same cow herd, one with an EPD of +40 lbs and one with an EPD of +15 lbs. The difference in EPD's is 40-15 = 25 lbs. The bull with the +40 lbs EPD would sire calves that would gain 25 lbs more on average than calves sired by the bull with a +15 lbs EPD, over a 140-day feeding period, if all were fed in the same group.

GENETIC EVALUATION OF POSTWEANING GROWTH ACROSS BREEDS: THE ACROSS BREED COMPARISON (ABC)

The Across Breed Comparison (ABC) for postweaning growth is calculated in a manner similar to that used to generate EPD's. It is the expected difference in progeny performance for postweaning gain in a 140-day period, but it is calculated on an across breed basis. Like the EPD, it is reported in lbs of gain in a 140-day postweaning period, and may be used to directly compare bulls from different stations. The ABC is calculated relative to the average performance of all bulls of all breeds tested. It may be used to fairly compare the relative genetic merit of bulls of different breeds for postweaning growth rate. This is very useful to herd managers utilizing crossbreeding, since they may want to select sires from amongst several breeds. It also allows valid comparison of bulls which are less than 7/8 purebred. These bulls receive a postweaning gain ABC, but do not receive an EPD. Bulls of breeds which have few animals tested receive an ABC, but not an EPD, since an accurate breed average is not available. Comparison of the average ABC of each breed gives an evaluation of the relative average genetic merit of each breed for postweaning gain (Table 3). Breed average ABC's will change over time. They are updated once a year.

ACCURACY

An EPD is the best estimate of that animal's genetic potential. As more information becomes available, the accuracy of the estimate increases. The accuracy value published with the EPD reflects the amount of information included in the estimate. In theory, accuracies may range from 0% to 100%. Accuracy increases as more records on the bull's relatives are added into the EPD calculation. Accuracy for bulls coming off test ranges from 38% to 62%. Within this range, selection of bulls should be based primarily on EPD or ABC, with minor emphasis on accuracy. Accuracy for older bulls which have had many progeny completing test will be significantly higher.

TABLE 3. Breed Average ABC's, June, 1990

Breed	Average ABC
Angus	-5.4
Blonde	2.4
Charolais	18.2
Chianina	5.4
Galloway	-35.9
Hereford	-14.6
Limousin	-8.1
Maine	15.1
Murray Grey	-41.2
Salers	-7.1
Shorthorn	-7.1
Simmental	16.7

USING THE POSTWEANING GAIN ABC

Consider two bulls of different breeds, to be used on the same cow herd, one with a postweaning gain ABC of +20 lbs and one with a postweaning gain ABC of -10 lbs. The difference in ABC's is 20 - (-10) = 30 lbs. The bull with the ABC of +20 lbs will sire calves which gain 30 lbs more on average over a 140-day postweaning period than calves sired by the bull with the ABC of -10 lbs, if all calves were fed in the same contemporary group.

ESTIMATING THE RELATIVE PREWEANING GROWTH OF PROGENY

The postweaning EPD's and ABC's can be used to estimate the relative difference in preweaning growth of progeny. This is due to the high correlation between postweaning and preweaning gain. The expected difference in the preweaning growth of progeny would be about 70% of the difference expected in the postweaning growth of progeny.

A bull's postweaning gain EPD is also a good estimate of that bull's EPD for 200-day weaning weight. Consider a bull with a postweaning EPD of +30 lbs. This is 30 lbs of postweaning gain more than an average bull (EPD = 0 lbs) of this breed. The 30 lbs in 140 days is equivalent to 30/140 = 0.214 lbs/day. With a correlation of 70% this would equate to 0.214 x 70% = 0.15 lbs/day of gain during the preweaning period. For a 200-day preweaning period, this would result in 200 x 0.15 = 30 lbs of weaning weight. Calves sired by a bull with a postweaning gain EPD of +30 lbs would be expected to average 30 lbs heavier for 200-day adjusted weaning weight than calves sired by an average bull of that breed, if all were raised in the same contemporary group.

The total growth advantage for calves sired by the +30 EPD bull relative to calves sired by a breed average bull would be:

30 lbs	for	200-day weaning weight
30 lbs	for	140-days postweaning
60 lbs	at	340 days of age

A bull's ABC for postweaning gain is also a good estimate of that bull's ABC for 200-day weaning weight. Consider two bulls of different breeds to be used on the same cow herd. One has an ABC of +20 lbs, while the other has an ABC of -15 lbs. The difference in ABC's is 20 - (-15) = 35 lbs. This amounts to 35/140 = 0.25 lbs/day. With the 70% correlation between preweaning and postweaning gain, this would equate to 0.25 x 70% = 0.175 lbs/day of preweaning gain. Over a 200-day preweaning period, this would result in 200 x 0.175 = 35 lbs of weaning weight. Calves sired by a bull with an ABC of +20 would be expected to average 35 lbs heavier for 200-day weaning weight than calves sired by a bull with an ABC of -15 lbs, if all were raised in the same contemporary group.

The total growth advantage for calves sired by the +20 ABC over those sired by the -15 ABC bull would be:

35 lbs	for	200-day weaning weight
35 lbs	for	140-days postweaning growth
70 lbs	at	340 days of age

SCROTAL CIRCUMFERENCE

Measurement of scrotal circumference (SC) provides a tool for evaluating a bull's semen producing ability. Scrotal circumference is highly heritable and positively correlated with semen quantity and quality. Scrotal circumference is negatively correlated with age at puberty (larger SC is associated with earlier puberty). Actual scrotal circumference at puberty is fairly constant across breeds, averaging about 28.5 cm. Some research has found that SC of sires is favorably correlated with reproductive traits in their female progeny, such as age at puberty and pregnancy rate. If these findings are substantiated by further research, this would be of importance in the improvement of the genetic potential of fertility in females. Direct selection for female fertility has been ineffective because of low heritability.

A recent field survey in Ontario (McMorris and Wilton, 1988) found little relationship between scrotal circumference and fertility of yearling bulls (as measured by % calf crop and % early born calves). Cow:bull ratio in this survey averaged 25.5:1. Scrotal circumference may be more related to bull fertility at higher cow:bull ratios.

BACKFAT THICKNESS

At the end of test, bulls are ultrasonically measured for backfat thickness between the 12th and 13th ribs. The ultrasonic measurement, in conjunction with the bull's end of test weight, can be used to assess the finishing ability of the bull. Fat depth has a high heritability of about 50%, so the sire has a significant

genetic influence on the finishing characteristics of his progeny. Depth of fat cover over the back between the 12th and 13th ribs is one of the criteria used in assigning a quality grade to beef carcasses. The ability of a feedlot animal to produce a carcass which will obtain a top quality grade within the weight range considered to be optimum by packers is an important economic consideration.

HEIGHT

At the end of test, bulls are measured for height at the hook bones. When considered with weight, age, backfat and muscling, it provides an indication of the bulls "type".

REPRODUCTIVE PERFORMANCE OF TESTED BULLS

A survey of consignors and users of performance-tested bulls was conducted in 1988 by McMorris and Wilton. Consignor surveys covering a total of 2,454 bulls completing test, and user surveys representing 411 bulls used as breeders were returned. Of the bulls exposed to cows, a total of 97% were classed as satisfactory breeders by producers. The breedings resulted in an average percent calf crop of 93.5%. On average, 49.5% of the cows calved during the first 3 weeks of the calving season. These results are consistent with those of a smaller scale survey conducted by Wilton and Robinson in 1981, which found that 97% of tested bulls were rated as average or above average for breeding performance.

PRIVATE BULL TEST GROUPS

It is possible to conduct an OMAF approved bull evaluation in a privately run facility (including a home farm) providing the requirements for a private test group are met. The requirements include a minimum group size and address various management factors. Choice of feedstuffs is at the discretion of the private group manager, although certain minimum nutrient specifications must be met. All costs for items such as feed, health care, etc., are borne by the individual bull owners. Organizing a private test group requires advance planning and consultation with the Beef Improvement Program office. To obtain a copy of current private test group requirements, contact the Beef Improvement Program office at (519) 836-3560. All groups must be approved by the Beef Improvement Program Manager or the Coordinator of the Bull Evaluation Program before commencing.

MANAGING THE YEARLING BULL

After choosing and buying a yearling bull, the main concern should be how to care for him so that he performs up to his potential. The following points may be used as a guide:

1. Bulls should be transported in a clean, well-bedded, covered truck. Sand should be put on the floor of the truck to prevent slipping. Bulls that are trucked together should be separated by a gate or partition.
2. Purchase bulls 60-90 days before the breeding season to give them time to adjust to new feed and new conditions.
3. The newly purchased bull should be isolated from other cattle for a month as a herd health precaution. He should have a clean pen of about 150 square feet and he should also have access to a well-fenced pasture or large corral, when he is not running with the herd, to provide plenty of exercise.
4. If possible, find out what the bull's ration was prior to purchase. Any change in feed should be gradual. The objective of feeding a bull between one and two years of age should be to obtain a daily gain of approximately 2.0 lbs (depending on breed). A typical daily ration might consist of good hay free-choice, along with .5 to .75 lbs of grain corn per 100 pounds of body weight. If the hay is not of good quality, the amount of grain should be increased to 1.0 lb per 100 lbs of body weight plus 1.0 of 40% protein supplement.

   High energy rations should be avoided as bulls may become excessively fat. This could reduce the reproductive performance, as sex drive and semen quality are adversely affected by this condition.
5. Salt and a calcium-phosphorus mineral mix suitable for the feeding situation should be provided free-choice.
6. Adequate vitamin A is necessary for good semen quality. Most rations contain some vitamin A. However, it is relatively inexpensive and should be supplied at the rate of 35,000 to 50,000 IU per day. Vitamin A may be fed as a dry supplement or given as a liquid injection.
7. During the breeding season, energy requirements are very high and consequently bulls often lose weight. In anticipation of this, the amount of grain may be increased for about one month before the breeding season. Some cattlemen give their young bulls short rest periods of 2 or 4 days throughout the first breeding season. During this rest period, supplemental feed may be offered.

COW TO BULL RATIO

In order to maintain a high conception rate in a 60-day breeding season, bulls should not be overworked. In a pasture breeding situation, a yearling bull should be able to breed 15 to 20 cows in 60 days. In a "hand mating" system, (bull put in a pen with cows exhibiting estrus), the yearling bull should be able to settle 20-30 cows in 60 days.

For more information on bull management see OMAF Factsheet, *Selection, Feeding and Management of the Beef Herd Sire*, Agdex 423/51.

For more information on genetic evaluation see:

-OMAF Publication 41, *Using Performance Records in Beef Production*
-OMAF Publication 206, *Expected Progeny Differences For Beef Cattle*
-OMAF Publication 201, *Principles Of Genetic Improvement In Beef Production*
-OMAF Factsheet, *Beef Breeding Terms Defined*, Agdex 420/21

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